Little. The final value 55·84 is sufficiently far from a whole number to suggest the existence of isotopes, for there is every reason to believe that this value is well established. In view of Dr. Aston's work, and the resuscitation of Prout's hypothesis, it will be interesting to learn how the difference from the integer is to be accounted for. Chap. 4 deals with the important subject of the corrosion of iron, of which the editor has made a special study. It is, however, remarkable, in spite of the large amount of work which has already been done on this subject, how much remains to be ascertained. The remaining chapters, five in number, deal with the general properties of iron salts, of its compounds with hydrogen and the halogens, and with the elements of Groups VI., V., IV., and III. of the Periodic Table. The whole concludes with a chapter on the detection and estimation of iron.

As in the case of the entire work, a special feature is a wealth of bibliographical reference. Practically every statement can be verified by reference to the original source of information. This, of course, adds greatly to the value of the treatise as a compendium, but it is naturally not of much service to the student without access to a well-found library. There is probably no single library in London in which all the books thus referred to could be found.

A new feature in the work is the inclusion of a table giving a list of important journals and periodicals dealing with chemical matters, with the dates of issue of their several volumes, from the year 1800 down to 1919. It was compiled by Mr. Clifford, the librarian of the Chemical Society, and occupies some eight pages of the book. Its value to the book itself is not very apparent, since the date of publication in the case of any particular reference is invariably given in the footnote. The table has no special appropriateness to the volume under review; its proper place would be either at the beginning or the end of the completed work.

(3) The "Dictionary of Chemical Solubilities," by Drs. A. M. Comey and Dorothy A. Hahn, is a revised and enlarged edition of a work by the first-named author which appeared in 1895, and which, in its turn, followed the well-known "Dictionary of Solubilities" compiled in 1864 by Prof. F. H. Storer on a plan indicated so far back as 1731 by Peter Shaw. Storer's book is long since out of print, and no attempt has been made to bring it up to date and to reissue it. During the quarter of a century which has elapsed since the first edition of Dr. Comey's work a large amount of additional matter relating to the solubilities of inorganic substances, with which the book is alone concerned, has made its appearance. This has been carefully brought together by Dr. Dorothy A. Hahn, of Mount Holyoke College, and forms the material upon which the present edition is based. It constitutes a volume of 1140 closely printed pages, and its subject-matter has been brought down to 1916. Its printing and publication have been delayed by circumstances arising out of the war.

In a work of this kind easy reference is of primary importance, and opinions may differ as to the best arrangement to adopt. The one used is practically alphabetical, but it will be obvious that such a scheme leads to occasional anomalies, which could be obviated only by elaborate cross-referencing, thereby adding considerably to the bulk of the volume. In the case of discrepant statements by different observers, no attempt at a critical selection has been made, which we think detracts from the value and authority of the work. A careful examination of the original papers and of the methods and apparatus employed would have enabled a satisfactory judgment to be reached, and thereby obviated much unnecessary printing. Methods of determining the solubilities of gases, for example, have been improved greatly since Bunsen's time, and many of his estimations have been superseded by more accurate observations. It serves no useful purpose to retain them, and indeed only confuses the searcher, who is not in a position to discriminate between the several observers. The compilers may rightly say they have done their best to deal with the enormous mass of material they have collected, but they can scarcely have escaped the conviction that much of the numerical data rests upon a very insecure experimental basis. The fact is, it is only within quite recent times that methods of estimating solubilities have reached the necessary precision, and that sources of error hitherto overlooked have been obviated.

In spite, however, of these difficulties and imperfections, the present work is the most comprehensive compilation on the subject which has yet appeared in any language, and a word of commendation is due to Dr. Hahn for the patience, care, and assiduity with which she has collected the vast amount of material with which she has had to deal.

Formal and Philosophical Aspects of Logic.

Logic. By W. E. Johnson. Part 1. Pp. xl+255. 16*s.* net. Part 2. Demonstrative Inference: Deductive and Inductive. Pp. xx+258. 14*s.* net. (Cambridge: At the University Press, 1921, 1922.)

A LOGICIAN is a person who takes infinite pains to solve problems which present no manner of difficulty to ordinary mortals. This may be, and no doubt is, because ordinary mortals live and die unconscious of the inconsistencies of general theory. The logician is therefore of necessity a very serious person, and to suspect a twinkle in his eye when he is propounding his problem is to undermine his authority. But there is another reason why he must be serious. If he would make formal logic a distinctive science he must walk warily between the devil and the deep sea, for on the one hand he has to beware of falling into pure matters of grammar, the use and misuse of the parts of speech, and on the other hand he has to avoid the abyss of metaphysics. Indeed if one were to take a pencil and score through everything in a treatise on logic which really depends on an intelligent understanding and use of grammar and everything also which depends on a disputable metaphysical theory, it would be difficult to be sure that anything would remain. There used to be a subject, taught at universities, called rhetoric, and many chairs of it still survive, but it would puzzle any one now to say definitely what a professor of rhetoric is expected to teach. It looks as though logic may some day and very soon be in a similar case.

Two parts of Mr. Johnson's logic are yet to come. The two parts before us are exceedingly well written. Every sentence is a model of clearness and lucidity. However puzzled the reader may be when he discovers the sort of problems he is invited to discuss, if he yields to the spell and plays the game, he will find a certain philosophical interest which will engage his attention throughout.

The influence of "Principia Mathematica" is very much in evidence; probably without that work few of the problems here dealt with would have had any *raison d'être*, even if they had been discovered to exist. Thus Mr. Johnson makes a very important point of a division he proposes between propositions, verbally identical, into primary and secondary. Truth and falsity, he tells us, can be predicated of propositions in quite different senses according as they are one or the other. "Some fairies are malevolent" if it is a primary proposition is necessarily false because fairies do not exist. But if it applies to "descriptions" of fairies then, as descriptions exist, it is true, and it is a secondary proposition. Similarly, in the chapter on negation we are asked to consider propositions such as these opposites. "An integer between 3 and 4 is prime" and "An integer between 3 and 4 is composite." Here we are told that though one is contradictory of the other, neither is true because both have a non-existent subject. This is in keeping with the endless interest Mr. Russell discovered in the question of the truth or falsity of the proposition "The present King of France is bald." All one can say is that if any nonsensical content becomes a proposition once it is invested with the propositional form, then logic had better be abandoned to those for whom games are the serious business of life.

The author's main purpose, however, seems to be a more exact classification and an improved terminology. He thinks the serious objection urged against the correspondence theory of truth can be got rid of by substituting the terms "accordance" and "discordance" for correspondence and non-correspondence. We may admit that the new terms are in a sense non-committal, but is that a gain? Another proposal is concerned with the subject of Modality. It is to substitute "certified and uncertified," for the term problematic, and to distinguish the certified into formally certified and experientially certified, apparently in order to have technical terms in logic for the old philosophical distinction between truths of reason and matters of fact. Also for "necessary" he would substitute two pairs of terms, nomic and contingent, and, epistemic and constitutive. The peculiar character of proper names he proposes to designate by the term "ostensive." In all this we seem to be hearing the echo of Mr. Russell's complaint that we shall never make progress in science until we construct and use a scientific language.

Perhaps the most novel thing in the logical theory expounded in Part 1 is the Paradoxes of Implication. The "typical paradox" is certainly not what we ordinarily designate by that term, and the author is aware that his use requires justification. A paradox in the ordinary meaning is the affirmation of a proposition the actual terms of which include its negation, as for example, "Whoso loses his life shall save it." The essence of the paradox is that despite its apparent contradiction in form it contains defensible philosophic truth. The logical paradox here discussed is very different. You may be led by implication (p implies q) technically correct, to the form "if p then q" where p may stand for the proposition $2+3=7$ and q for the proposition "it will rain to-morrow," then you have the paradox. At this point no doubt the ordinary person would lose interest, but if you are a logician it is here the problem becomes engrossing.

One very interesting discussion, also in Part 1, is the famous Leibnizian principle of "the identity of indiscernibles." No one can fail to see that metaphysically the principle is an essential part of the concept of substance, yet logically there seems no way of keeping this in view, and the author reaches the conclusion—which is quite correct on his principles—that it seems to him in any case to have no logical justification whatever.

In Part 2 there is a distinct increase in the philosophical interest. The difference between the aspect of a problem to the philosopher and to the logician becomes more marked, and the author is sometimes at pains to show that the doctrine he is discussing has reference purely to formal logic. The subjects dealt with are of the first importance. For example, the relation of logic to mathematics is discussed with very penetrating criticism, and Mr. Johnson finds that he differs from Mr. Russell on the fundamental concept of this relation. The mathematical function is for Mr. Russell a description derivable from the propositional function of logic, whereas Mr. Johnson argues that the propositional function of logic is nothing but a particular case of the mathematical. In discussing functional deduction generally Mr. Johnson says "the essential purpose of symbolism is to economise the exercise of thought; and thus symbolic methods are worse than useless in studying the philosophy of symbolism or of mathematics in particular."

There are many new distinctions discovered and new terms proposed. In particular we are to distinguish two direct principles of inference, the applicative and the implicative, each with a counter principle; we are to add to the distinctions of magnitudes as extensive and intensive an intermediate form termed distensive; and, more important still, we are to distinguish between the question of the absoluteness or relativity of space and time and the question of their substantival or adjectival nature. But perhaps the most astonishing distinction of all (is it a new discovery?) is that of the syllogism and the antilogism. The antilogism like the syllogism has its four modes AEIO, and, in the illustration given, simply by altering the mode we can present the argument for new realism, the argument for Hume's scepticism, or the argument for Kant's formalism. Verily formal logic may be in the way of becoming a formidable weapon in the hands of a philosophical controversialist.

Terrestrial Magnetism in the Antarctic.

British ("Terra Nova") Antarctic Expedition, 1910–1913: *Terrestrial Magnetism.* By Dr. C. Chree. Pp. xii + 548 + 60 plates. (London: Harrison and Sons, Ltd., 1921.)

BOTH of Captain Scott's Antarctic expeditions included observations of the earth's magnetism in their programme of scientific work, and the experience gained in the first was turned to good use in the second. The two magnetic observers were Dr. G. C. Simpson and Mr. C. S. Wright, to whom is due the credit for the fine work done at the base station. A noteworthy improvement was made by Dr. Simpson in the method of time-marking on the magnetograph sheets, which has since been adopted in some regular magnetic observatories. The magnetographs were in operation for nearly two years (February 1911 to November 1912); at the beginning of the second year Dr. Simpson was recalled to his official duties in India. Besides the continuous record of the three magnetic elements at Cape Evans, a considerable number of absolute measurements were made by the naval officers of the expedition, both in the "field" (principally at Cape Adare) and at sea.

The important task of preparing a report describing and discussing all these observations was entrusted, as in the case of the former expedition, to Dr. Chree. This report has just been issued, in the form of a large quarto volume, prepared and published at the cost of the fund raised by public subscription in memory of Captain Scott and his companions. Apart from the observations taken by the naval officers, which were mainly reduced by themselves, not only the discussion but also the reduction of the observations has been executed by or under the supervision of Dr. Chree; the measurement of the magnetograph curves, the reduction of the measurements, and the discussion of the important but somewhat tedious instrumental questions which arise, involve an amount of labour which can be but little appreciated by those unfamiliar with the subject. Of the 548 pages of letterpress, about one hundred are devoted to the tables, giving hourly values of the three magnetic elements, while about one-quarter of the volume is occupied by a valuable set of plates, mainly reproducing actual magnetograph records, from the Antarctic or elsewhere.

Following out his characteristic plan, Dr. Chree has kept strictly to the comparison and discussion of facts as facts; the echoes of theoretical controversy can be at most remotely perceived, and speculations as to the cause of the phenomena reviewed with such painstaking care are expressly deprecated by the author. Whether or not it is best at all times to restrict the discussion within these severe limits of certainty, few can disagree with the adoption of the course in preparing a report of this kind. In the spirit with which he has approached the task Dr. Chree has shown, not only his devotion to his chosen science, but also his personal appreciation of the work done by those who obtained the observations, or made the observations possible, in the inhospitable regions of the Antarctic.

The general plan of the volume is similar to that of the one dealing with the earlier expedition. The first six chapters describe the reductions which lead to the monthly mean values, non-cyclic changes, diurnal inequalities (with Fourier coefficients), daily range, and daily maxima and minima of the magnetic